

MISCELLANEOUS PUBLICATION No.6

MACARIA

MOSQUITO



VECTOR CONTROL RESEARCH CENTRE

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MOSQUITO

COMMUNITY HEALTH CELL

Mosquitoes are the most important single group of insects in terms of public health significance. Despite several attempts to control them, these remarkably adapted insects continue to successfully co-exist with man, feeding on him and his domesticated animals. The loss of blood due to mosquito bites is ~~colossal~~.

It is estimated that if ten mosquitoes bite a man per night a human population of one million would be losing approximately 50 litres of blood per night.

Besides the blood loss they are also capable of transmitting many diseases like filariasis, malaria, yellow fever, Japanese encephalitis, dengue etc.

40 million people in India suffer from mosquito borne diseases annually.

There are over 3000 mosquito species belonging to 34 genera in the world. Of these, only about 300 transmit human and animal diseases. About 50 species of anopheline mosquitoes are found in India. Of these about 10 are vectors of malaria. These are Anopheles culicifacies, Anopheles fluviatilis, Anopheles stephensi, Anopheles sundaicus, Anopheles minimus, Anopheles balabacensis, Anopheles

philippinensis, *Anopheles annularis*, *Anopheles varuna*, and *Anopheles jeyporiensis*.

The incidence of Malaria in India has reached a plateau at about 2 million cases annually.

The *Culex* fauna consists of 57 species. *Culex quinquefasciatus* transmits filaria caused by the nematode *Wuchereria bancrofti*. The genus *Mansonia* is represented by seven species. Of these *M. annulifera* and *M. indica* transmit *Brugia malayi*.

Latest official estimates in India showed that 304 million people are reported to be exposed to the risk of infection with an estimated 22 million microfilarial carriers and 16 million chronic filariasis cases. It is thus said that every third person in India runs the risk of filarial infection.

Culex tritaeniorhynchus and *Culex vishnui* group of mosquitoes transmit Japanese encephalitis. The genus *Aedes* is represented by several species in India. Only *Ae. aegypti* is the vector of dengue haemorrhagic fever.

Approximately about 1 million people in India are said to suffer from these diseases annually.

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LIFE CYCLE

Life cycle of mosquitoes is complex in nature since a part of it is spent in the aquatic environment and part in a terrestrial environment. The mosquito life cycle consists of four stages namely EGG, LARVA, PUPA and the ADULT. Except for the adult stage, all the other stages develop in water (aquatic stages).

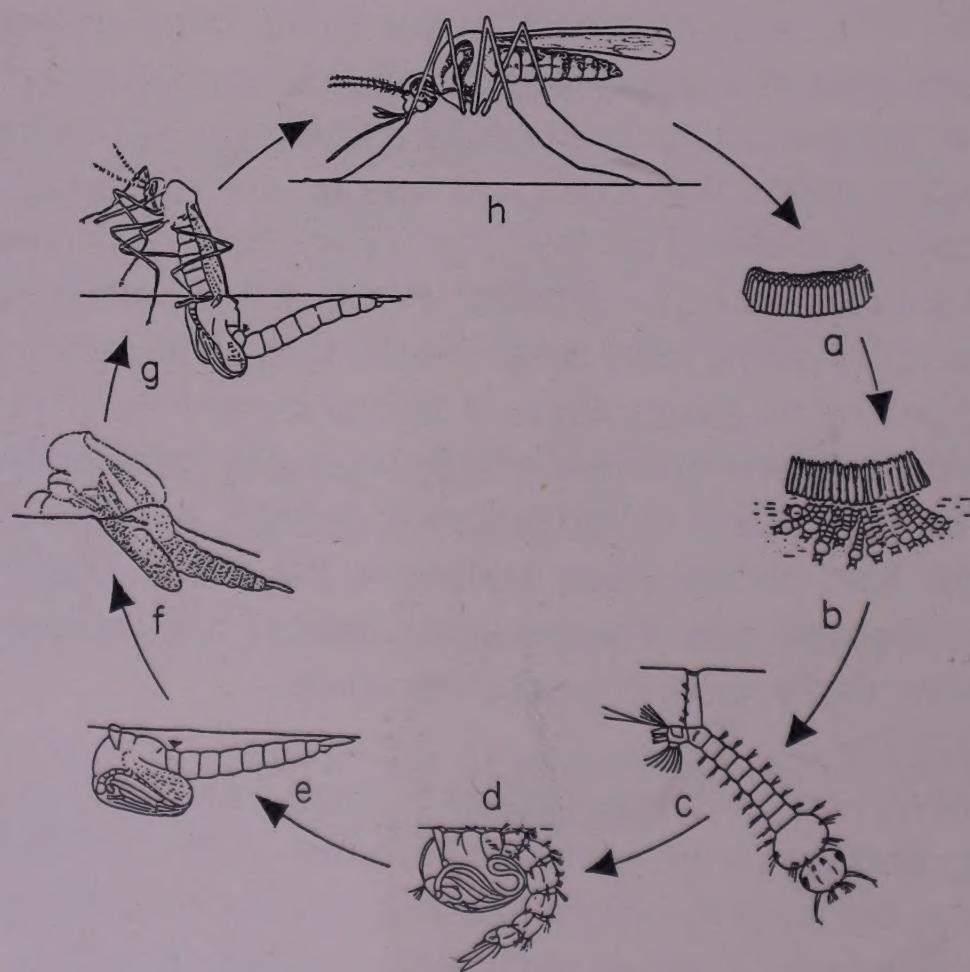
EGG : The eggs are generally laid on the water surface (as in the case of Culex and Anopheles) or on damp surfaces near water sources (as in Aedes and Armigeres). There is a misconception that trees and bushes are responsible for mosquito breeding but they only provide ideal resting places for outdoor resting mosquitoes. However water stagnation in tree-holes during rainy season is found to be an ideal breeding ground for Aedes. Eggs of mosquito are laid either in the form of rafts as in the case of Culex spp. (Fig 1a) or individually as in the case of Aedes and Anopheles species. These eggs float on the water surface and number varies from species to species. These eggs hatch into 1st instar larvae (Fig 1b) within 24 hours in tropical conditions.

LARVA : The larva emerges out of the egg with the help of an egg breaker on its head. The larva then begins to feed and grow bigger and bigger. Mosquito larvae are very active swimmers and they feed on organic particles, dead plant substances and other planktonic substances. When grown sufficiently, the outer body cover is periodically discarded by a process called moulting and the subsequent stage is the next instar. The mosquito larva has four such instars and the fourth

instar larvae (Fig 1c) moults into the next stage of the life cycle called pupa.

PUPA : The pupae are 'Comma shaped' with a flexible abdomen for swimming and a pair of trumpet like structure on the dorsal surface for breathing (Fig 1 d). They are lighter than water and float at the surface of the water. They appear as round immobile floating bodies and when disturbed they are as active as the larval stage and moves about in water by the jerking of its body. In about 2 - 3 days the pupa splits and the adult emerges (Fig 1 e & f).

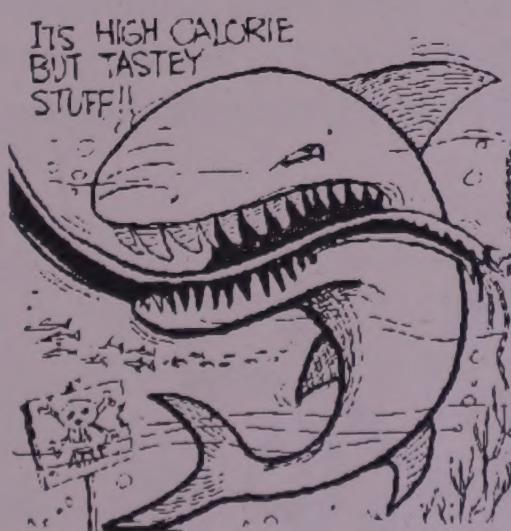
Fig.1



Developmental period from egg to adult varies from species to species and is also temperature dependent, though in tropical conditions it is about 7 - 10 days.

ADULT : Equal numbers of male and female adult mosquitoes continuously emerge from the breeding sites . The emerged adults (Fig 1 g) rest for some time near the breeding site and later flies off to suitable resting sites till its wings and legs are well stretched and body hardens. It is the female mosquitoes that bites man and sucks the blood for the development and maturation of its ovaries. During the act of feeding (blood sucking) these mosquitoes inject their saliva into the host (man) and during this process it transmits parasites, which subsequently manages to develop within the body of man and causes diseases such as Malaria, Filaria, Japanese encephalitis and Dengue. In general first blood meal is taken on the third day after emergence and subsequently every second day. On an average adult mosquito survives for 15 to 30 days in tropical climate.

The male mosquitoes on the otherhand feeds only on plant juices and nectar and it mates with the females to produce fertilised eggs.



BREEDING HABITATS

The breeding habitats of mosquitoes vary from large and usually permanent collections of water, such as fresh water swamps, marshes, rice fields and burrow pits to smaller collections of temporary water such as small pools, puddles, ditches, drains and gulleys. A variety of natural habitats such as water filled tree holes, rock pools, water filled bamboo stumps, leaf axils, water filled split coconut husks, crab holes and snail shells serve as ideal breeding ground for freshwater breeding mosquitoes like Anopheles and Aedes. While natural habitat provide ideal breeding ground for mosquito in rural areas, man-made habitats are the major contributing factors in urban areas. These habitats can be classified into two major categories ie. polluted water habitats and stagnant clean water ones. The polluted water breeding habitats supports breeding of Culex quinquefasciatus and Armigeres sp and these habitats are :

CESSPOOLS : Low lying areas accumulate rain water and also the effluents from nearby houses and finally becomes highly polluted to support mosquito breeding.(Fig.2)

Fig.2



CESSPITS : These breeding sites are mainly man made and indispensable where facilities to dispose the sullage and sewage is not available. Generally these pits are about 1mt. in diameter (Fig.3) and each household digs up a pit for letting out the effluents and as the water accumulates and stagnates, they become favourable for Cx. quinquefasciatus breeding.

Fig.3



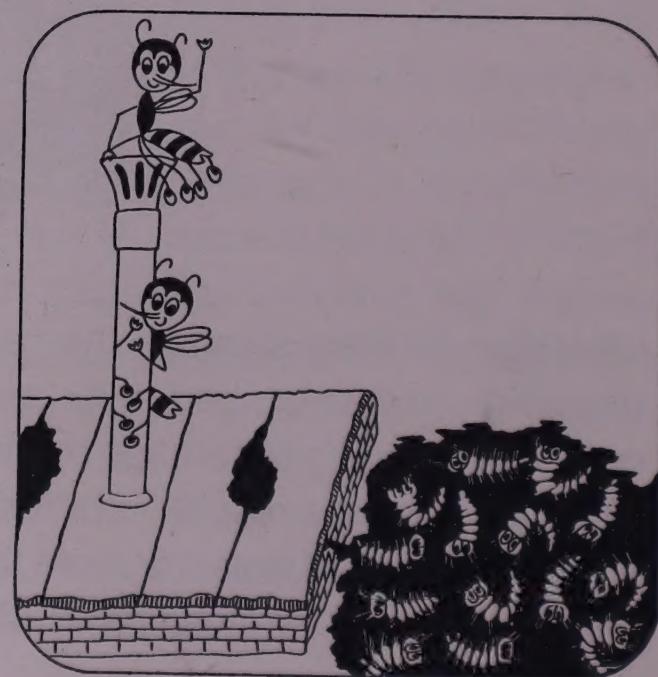
DRAINS : In ideal situation the drains are not suitable for breeding . However, bad engineering practices and indiscriminate dumping of garbage by the people as well as by the municipal workers results in blockage of flow in the drain. Such stagnation of water for more than a week provides ideal breeding ground for mosquitoes (Fig.4).

Fig.4



SEPTIC TANKS : These tanks are the major means of sewage disposal in areas where proper underground sewage systems are lacking. This is mainly found in new residential areas. Septic tanks are provided with vent pipes for the escape of obnoxious gases and outlet of excess water and these outlet pipes are often left open, mosquitoes manage to enter through these pipes and prolific breeding takes place within the tank. Occasionally the excess water from these tanks instead of being diverted into soakage pits, is let into either a drain or allowed to form a puddle which in turn breed mosquitoes. (Fig. 5)

Fig.5



WASTE WATER FROM CATTLE SHED: It is a common site to find milch cattle in many houses and these are tethered either inside the houses or on road sides and in majority of the cases these sheds are poorly maintained and on the road-sides the flow of kutcha drains are blocked by these animals and this leads to breeding of mosquitoes. Even hoof marks

of these cattle can accumulate water sufficient enough to support breeding of mosquitoes.(Fig .6)

Fig.6



Clean water breeding habitat support Anopheles and Aedes sp. Anophelines can breed in several temporary and permanent habitats such as:

PUDDLES : Leaking public taps due to negligence and often pilferage of the taps, water goes on flowing from the taps creating mosquito-genic conditions around them (Fig .7 & 8).

Fig.7



Fig.8.



RECEPTACLES : Discarded tins, water storage mud pots (Fig .9), plastic containers, waste bottles, soap boxes, tar drums, flower pots and grinding stones provide ideal breeding sites for mosquitoes soon after rains. Though individually each of these habitats are of minor importance but collectively their contribution could be substantial.

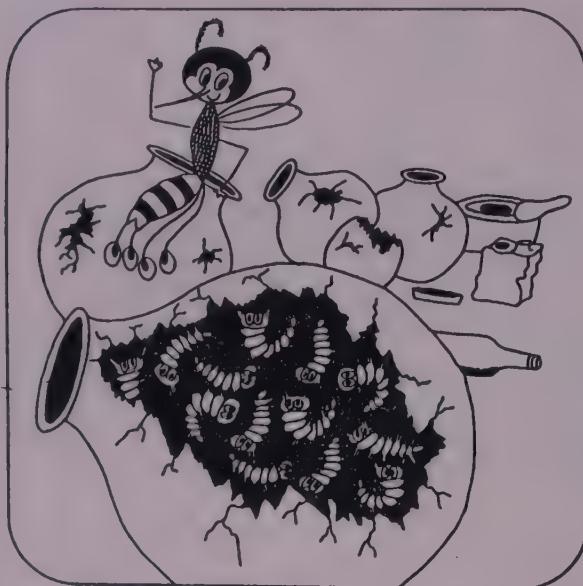


Fig.9

OVERHEAD TANKS : Majority of the overhead tanks are the ideal breeding ground for anopheline mosquitoes transmitting malaria in urban areas, when kept open. (Fig.10)



Fig.10

WELLS : Provision of protected water supply to almost all houses has led to the disuse of existing wells. The dumping of garbage and letting out of effluents into these wells converts them into breeding places (Fig.11)

Fig.11



MISCELLANEOUS

Eggs of Aedes sp. are known to withstand dessication and this species is capable of breeding in any temporary and permanent freshwater habitats such as tree holes (Fig .12), discarded tyres (Fig 13), water storage tanks etc. Culex tritaeniorhynchus breeds mainly in paddy fields (Fig 14).

Fig.12



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Fig.13



Fig.14

A few mosquitoes like Anopheles sundaicus breed almost exclusively in brackish or salt water, such as salt water marshes and mangrove swamps and are consequently restricted to mostly coastal areas.

Though almost any collection of permanent or temporary water can constitute a mosquito larval habitat, they are absent from large expanses of uninterrupted water such as lakes, especially if they have large numbers of fish and other predators which are likely to feed on the mosquito larvae. They are also absent from large rivers and fast flowing streams, except that they may occur in marshy areas and isolated pools and puddles formed at the edges of flowing water. (Generally smaller water bodies which are inaccessible to predators are the major breeding sites of mosquitoes).

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CONTROL MEASURES TO BE IMPLEMENTED BY THE COMMUNITY.

Mosquitogenic conditions can be reduced or even eliminated if the community can play an active role in its eradication rather than being a passive observer. Breeding can be prevented if the people follow the guidelines given below:

1. Do not throw garbage except in dustbins. Throwing garbage in drains will block water flow.
2. Keep the septic tanks and over head tanks sealed properly to prevent the entry and exit of mosquitoes.
3. Do not allow water to stagnate in any open container for more than one week.
4. Cultivate kitchen gardens where effluents from the houses could be diverted.
5. Release larvivorous fishes in open tanks.

6. If there are any large body of stagnant water within the vicinity of your house, the local authorities must be contacted immediately for rapid remedial action.
7. If the construction of the drains or public latrines are improper leading to mosquito breeding, it should be brought to the notice of higher authorities.
8. Any leaky water taps should be repaired immediately since it could lead to stagnation and mosquito breeding.
9. Do not throw empty tins, pots, containers and used tyres on the terrace and allow water to stagnate in it.
10. All water bodies in and around the houses should be kept free from all vegetations and unused wells and ponds should be covered completely or filled up by waste garbage and mud.
11. Use of personal protection methods such as insecticides impregnated clothing, bednets, mosquito coils and mats should be encouraged within the community.

Printed at All India Press Pondicherry-605 001

